ENHANCING NORTHWEST FLORIDA FREIGHT MOBILITY THROUGH IMPLEMENTING OFF-HOUR DELIVERY OPERATIONS

Project Summary

June 11, 2021

FDOT

U.S. Department of Transportation
Federal Highway Administration

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Executive Summary

Project Synopsis

The United States Department of Transportation (USDOT) Federal Highway Administration (FHWA) partnered with the Florida Department of Transportation (FDOT) through a federal grant opportunity to evaluate the effectiveness of an off-hour delivery program for a distribution center within a small to medium size urban area. FDOT has previously partnered with FHWA for a similar study evaluating the effectiveness in the Central Florida region under different circumstances. For this project, FDOT initially proposed a partnership with Sacred Heart Health System in Pensacola, Florida. The Sacred Heart hospital is a regional health care facility that also acts as a distribution center for the Sacred Heart health network, which includes over 150 clinics and physician offices/facilities. The project aimed to evaluate both the impact of an off-hour distribution system, and an off-hour campus delivery schedule for goods servicing the main hospital, and its distribution network which is serviced from the dock/warehouse attached to the main hospital in Pensacola.

Sacred Heart Health System and its distribution logistics operator agreed to share information with the project team to enable the evaluation of an off-hour delivery program. This information included data for emissions, delivery times, schedules, routes, personnel hours, and metrics regarding the volume of goods being received and shipped. Along with this, Sacred Heart also provided a detailed log of running deliveries to support the main hospital and offered to coordinate with vendors to market and implement an off-hour delivery schedule, as well as provide data to the study.

However, due to unforeseen staffing changes, the study agreement became untenable and had to be reworked with a new partner. FDOT revised the work plan and identified Florida State University (FSU) as a partner to continue the study with. Objectives for the study were shifted and agreed upon by USDOT, FDOT, and FSU; the project would focus on localized impacts of freight deliveries for pedestrian and vehicular safety/mobility. FSU and the City of Tallahassee identified several challenges regarding freight and committed their resources to the project team to support the study and use its findings to recommend revisions to its master plan.

Impacts from the global COVID-19 pandemic began shortly after the project focus shifted to FSU, however the project moved forward utilizing pre-COVID-19 data to analyze movements of pedestrians, passenger vehicles and freight deliveries. To ensure implementation and data collection, FSU committed to the establishment of blanket policy that would restrict delivery hours and goods movement on campus. This would ensure that the alternative(s) developed by the team would be implemented in such a scale to collect sufficient data to support logical conclusions from the study.

Due to the length and the impacts of the COVID-19 pandemic, the University advised that its operations would be diminished for an indefinite amount of time, and that it would not be able to expect a return to previous operations prior to campus closure and remote learning implementation in the immediate future.

The updated objectives of safety and pedestrian interactions in this phase of the study required that the campus be operating at normal capacity in order to have measurable outcomes to the changes created by a shift to off-hour operations. As the pandemic continued it became evident that a new standard of university learning was coming with distance learning and that pedestrian interactions would be at minimal levels for the foreseeable future. Due to these changing circumstances, the project team decided that the project objectives are no longer achievable in the foreseeable environment, and that results should be analyzed as they stand to set a framework for potential future off-hour studies. Many of the lessons learned through this process are applicable to future studies.

Challenges

Over the course of the project across the two sites, one of the largest challenges was the availability of data to evaluate the measures of effectiveness as outlined in the technical work plan. Sacred Heart supplied a significant amount of information to support the project from its logistics program but, at the time, was not collecting a majority of the information required such as fuel data, vehicle run time, on time delivery percentage, et cetera, for its distribution network.

Due to the change in objective for FSU, a larger portion of the data was reliant on surveys of the student body, freight vendors, and facilities staff. Generally, the project had previously accounted for a survey of facility staff, and freight vendors. However, a survey of the student body required additional coordination with staff, and a review by university administration prior to collecting input from the student body. This was proposed by the project team, and FSU advised that there were active student governing bodies including the Student Government Association (SGA) that could assist with the distribution of the survey and intake of the results.

Vendor Coordination

Coordination with the vendors through Sacred Heart was met with significant challenge as many were neither receptive to the project, nor to lending data to the study. The FSU vendor coordination was on track to be more productive until the effects of the pandemic became the primary concern of the vendors.

On-Site Logistics

Sacred Heart Health System expressed concern about freight operations on its Pensacola campus, along with interactions with pedestrians and cited a challenge with organizing freight deliveries and structuring its logistic operations for its distribution network. The issues for this were further exacerbated by future planned construction that would limit freight access in the future to the

facility, along with growth in outlying parcels of the campus that would increase pedestrian and vehicular traffic. Sacred Heart helped the team identify potential freight mobility options around its campus but stipulated that its intent was to eliminate curbside deliveries that would hinder pedestrian and vehicle access and develop unsafe, or aesthetically challenging scenarios for patrons, staff, and visitors.

At FSU, a majority of its primary deliveries take place within three major receiving areas that were located around the campus, however, smaller sporadic deliveries occur around campus due to third party logistics (3PL) carriers, as well as small local deliveries for vending services and campus supplies. This posed a significant challenge that FSU staff identified due to the locations at which these deliveries were being made and interference with large student body movements throughout the day, creating safety risk scenarios with blocked sidewalks, roadways, or driveways. Aesthetic challenges were also identified, as was the need to improve overall quality of life around the campus by removing delivery and maintenance vehicles from more populated areas around the campus during the day. It was also suggested during initial meetings that some deliveries and maintenance operations may need to occur this way because of the layout of the campus and also timeliness of goods delivered such as perishable goods and operation hours of some facilities; the alternative should allow for these as special scenarios.

Approach

The technical work plan for the project included an analytical, data-driven assessment coupled with a qualitative assessment by facility and vendor surveys. As part of the approach, the project was supported by data from the freight operations at each facility, along with the data for the external factors associated with each objective. In order to facilitate this, the project was divided into phases to support coordination, planning, data collection, existing conditions assessment, alternative(s) development, implementation, and final analysis. For Sacred Heart, the project advanced into the alternatives development phase prior to being relocated. For FSU, alternatives were developed, and the facility staff were ready to coordinate for implementation when the impacts from the COVID-19 pandemic set in. For this reason, the project was halted as there were major disruptions on campus that would have hindered data collection and would have drastically impacted the implementation of the alternative(s).

Outcomes

Since the project did not advance into the implementation and final analysis phases, the outcomes of the study are reflective of only the phases completed. These outcomes include a detailed data analysis methodology that is scalable and transferable for future projects. These efforts also produced best practices and lessons learned to avoid various risks and offer better mitigation tactics for unavoidable circumstances.

Introduction

Background

In 2015, the US Department of Transportation (USDOT), Federal Highways Administration (FHWA) approved funding for the research project "Enhancing Northwest Florida Freight Mobility through Implementing Off-Hour Delivery Operations." The project recipient, the Florida Department of Transportation (FDOT), initially partnered with Sacred Heart Health System in Pensacola, Florida to carry out the project. In 2019, due to unforeseen staffing changes at Sacred Heart Health System, the study agreement became untenable and had to be reworked with the partnership being transferred to Florida State University (FSU) in Tallahassee, Florida. For the efforts at FSU, the project was re-evaluated to address location specific objectives with the focus switched to the effects of an off-hour delivery program impacts to mobility, safety, and aesthetics for a large pedestrian activity center.

Prior to this study, FHWA funded a similar pilot project in Central Florida to improve the freight delivery and operations at the Orlando Health Hospital in Orlando, Florida. This project coordinated with another FHWA project called the Freight Advanced Traveler Information System (FRATIS). The Central Florida study identified benefits from the evaluation of current operations and the implementation of a loading dock schedule for shipping and receiving through the decreased congestion at the loading docks, and more on time deliveries with carriers spending less time on site. Per the evaluation of the Central Florida study, it is estimated based on the shift in travel times, and decreased emissions resulting from off-hour deliveries that the total economic impact of the program is estimated at $263,746 annually, with $255,486 in travel time savings and $8,260 from reduced emissions. It was estimated that over a 30-year period, the program, if maintained at the partner facility, would create a savings of 7,600 vehicle hours for drivers delivering and receiving freight at the facility. The benefits also extended to driver welfare accessing the facility through decreased dwell time and increased productivity. While not quantified, it was noted that safety benefits may have also been achieved as the reduced congestion from dwelling trucks around the facility led to better access for pedestrians and cyclists on campus and minimal road blockages around the loading facilities at the partner campus. For the purposes of this study, the FRATIS system was not proposed to be utilized for either analysis at Sacred Heart or FSU.

Purpose

The purpose of this project is to analyze a strategy for improving freight supply and delivery operations in and around the Sacred Heart Pensacola main campus as a freight mitigation tool for local and regional operations. The Pensacola campus needed operational and logistics improvements for its existing campus as freight and truck traffic regularly conflicted with regular passenger traffic. Furthermore, as Sacred Heart had plans to expand the campus, improvements

were needed in order to create capacity to manage traffic needs for the future children's hospital and expanded Adult Acute Care Centers. The main goal of the project was to improve freight delivery operations at the Sacred Heart medical campus within Escambia County and throughout the regional transportation network.

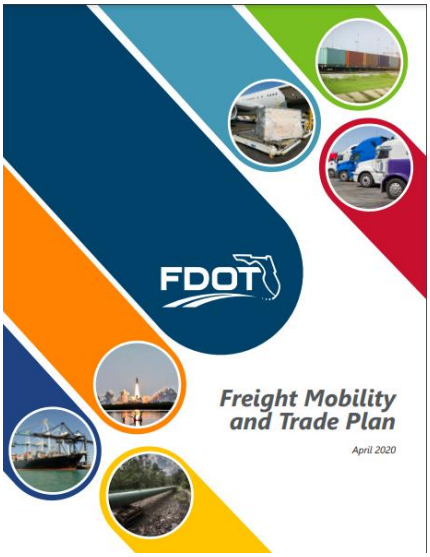
After the project was transferred to FSU, the overall project purpose remained the same; improving freight and delivery operations and logistics in a way that would benefit FSU and could also serve as a model for other locations. The specifics of the project objectives required modification due to the different nature of the FSU campus. The FSU campus is located in the heart of Tallahassee's urban core and has a consistently growing student population. The University has plans to expand to the southeast but has exhausted much of the existing real estate available on their current campus. The growth in the campus population corresponds to increases in both shipping and receiving freight traffic, which often conflict with pedestrian traffic. As such, the goal of the project at FSU was to improve the safety for all transportation modes (particularly pedestrians on the campus), discover operational improvements and efficiencies within logistic operations, and improve campus aesthetics by reducing the presence of freight operations during highly trafficked periods.

Goals and Objectives

The objective of the study was to determine the applicability of the off-hour delivery mitigation technique in a small- to mid-size urban area to alleviate freight impacts and improve localized mobility. To this end, the study had several goals that were focused around the analysis of the off-hour delivery program as it relates to the study area, the associated logistics impacts at the partner facility, and impacts to the vendor's operations that service the facility. The primary goals focused on the following:

- Understanding and demonstrating the applicability of an off-hour delivery program as it relates to:
  - Localized congestion (immediate vicinity of the facility)
  - Improving operations at the partner facility
  - Measurable travel time impacts for vendors accessing the partner facility
  - Positive environmental impacts (air quality, sound, aesthetics)
  - Identifying quality of life impacts (partner facility and adjacent land uses, drivers, on-site logistics staff)
- Development of a replicable, operations-based, freight mitigation tool for safety and traffic operations issues

For the State, this study addressed the objectives of the Freight and Mobility Trade Plan (FMTP): to develop a safe, efficient, sustainable, and resilient freight system. The FMTP outlines a technical approach to addressing federal concerns for national freight network sustainability and resiliency. The Plan also identifies key components for the advancement of Florida's Strategic Intermodal System (SIS) to support economic competitiveness by ensuring safe, and reliable freight networks for access by industry and commerce. The off-hour delivery program study fulfills various objectives of the Plan, some of which include:



1. Collaborate with public and private sector partners to address freight transportation and logistics needs and workforce development
2. Coordinate freight-related plans and programs of the private sector and local agencies with FDOT's plans for integrated and informed decision-making
3. Support projects that improve the efficiency of goods movement throughout the state
4. Understand unique needs of urban freight transportation and develop/enhance process to designate CUFC

The partners with the study also recognized the potential benefits that can be gained internally from the implementation of an off-hour delivery program, and their positive impact on the surrounding transportation system. Since both partners are large employers in their respective regions they each have substantial impacts on the communities in which they operate in.

Sacred Heart Health System, Pensacola, FL

Initial Goals

The Sacred Heart Health System partnership established goals to evaluate the applicability and efficacy of the off-hour delivery program across several areas. The Sacred Heart project team identified that existing challenges on-site, along with future expansions and campus developments, threatened to hinder freight operations. The team also identified that the logistics program at Sacred Heart would significantly benefit from the analysis proposed as part of the study, and thus committed to implementing a viable alternative in support of the analysis. Knowing this, the team established the following goals with Sacred Heart:

1. Control all deliveries
2. Establish a time of day schedule for vendors
3. Decrease interaction of freight movements with pedestrians and vehicular movements
4. Optimize logistics department efficiency
5. Develop a revised workforce plan
6. Increase quality of life for patients, visitors, and staff

Data needs were identified and a methodology was developed in order to successfully analyze the ability of the program to meet these six goals. After understanding these goals, and evaluating their feasibility for measurement, the off-hour team developed a detailed work plan that was approved by USDOT.

Project Work Plan

The work plan was developed to support a sequential project flow that starts with an existing conditions assessment, allows for data collection, analysis, alternative development, implementation, documentation, and constant communication amongst the project team. The design of the work plan allows for a cohesive management approach across all parties involved in the off-hour delivery study and details the following areas for the project:

- Project Management
- Scope
- Schedule

- Milestones/Deliverables
- Tracking
- Change Management
- Communications
- Cost Management
- Procurement Management
- Risk Management & Register

Project Management

The overall management and execution of the work plan was the responsibility of the Recipient Principle Investigator (RPI), Rickey Fitzgerald, FDOT's Freight and Multimodal Operations Manager. The daily management of the project fell under the responsibility of the Consultant Project Manager (CPM), Ryan Fetchko. For the partner facility, Sacred Heart designated an operations manager for the facility as the single point of contact (POC), who was later replaced by a logistics operations manager. The Sacred Heart POC had access to executive staff to inform of program activities and needs, as well as director responsibilities over departments where information or data was requested from. The project team staff reported to their respective organizational management. The coordination and communication with management staff regarding the progress and performance of each project resource was done by the CPM. The project and subsidiary management plans were created by the CPM and reviewed and approved by the project sponsor.

Project Scope

The study focused on the main campus building at Sacred Heart which houses the hospital with attached loading/receiving docks. The study site is located in a medium density area with planned expansions that are expected to exacerbate congestion problems.

Figure 1: Rendering of New Children's Hospital

The Sacred Heart facility management team advised that the need for an off-hour delivery program was imminent as a new wing of the hospital (Figure 1) would restrict access to the loading docks of the facility. Additionally, the facilities management wanted to better control delivery vehicles that were entering the campus and unloading at random locations. Since the Pensacola campus also acted as a distribution center, the facilities team advised that the project team would be able to leverage its data from its distribution network which provided soft and hard goods daily to the Sacred Heart satellite facilities across the Florida Panhandle.

The scope of work for the study included planning, stakeholder outreach, data collection, monitoring, and transition of an off-hour delivery system that supports freight deliveries and goods movements.

Data Collection

The project began by collecting information regarding the existing logistics operations, surrounding roadway conditions, local socio-economic data, and environmental information. Site visits were then conducted to identify safety concerns, points of conflict, site distance issues, and other visual observations. The collected data was then used to create a comprehensive baseline logistics profile for the campus.

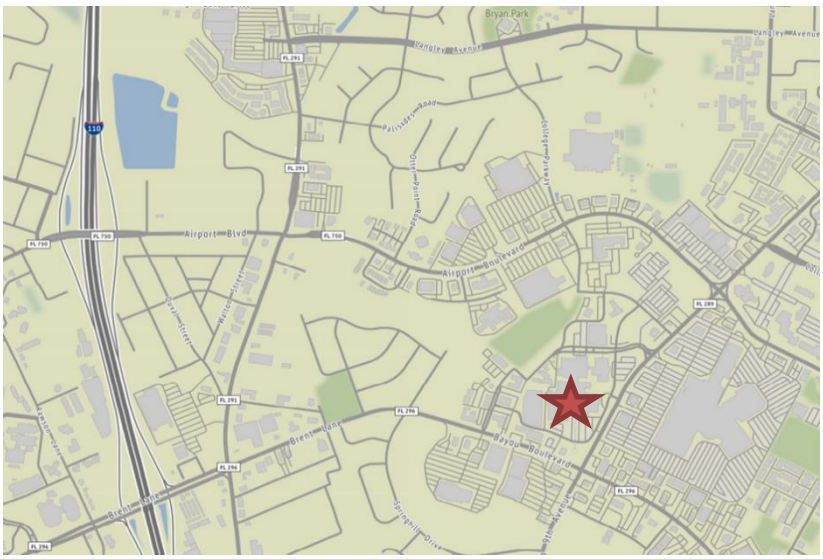


Figure 2: Sacred Heart Pensacola Campus Location

Traffic data was collected for a period of seven days total with 24 hours of count data each day at the major campus entrances. Figure 3 provides a graphical depiction of the campus layout with the entrances where data was collected. Traffic data for roadways immediately surrounding the campus was observed to assist in the development of peak period activity for the campus. The traffic data at the campus was used to understand the peak periods of vehicle entrances and exits by vehicle type.

The unique distribution network at Sacred Heart provided additional data points regarding delivery routes, time of day services, and regularly scheduled cross-docking applications to facilitate the distribution routes. Along with this, a detailed list of vendors and their regular windows for deliveries was provided, as the hospital maintains a log of time-sensitive/critical deliveries as well as commodity goods deliveries which are more sporadic and unpredictable. The hospital also provided metrics for on-site pedestrian information. The location of the main parking garage and main entrance caused regular interference of freight vehicles with pedestrian and passenger vehicle movements. Sacred Heart did advise that there were recorded instances of freight incidents with pedestrians and other vehicles, but the data was not shared with the project team.

The delivery logs and vendor information for Sacred Heart were provided via a detailed digital database which was analyzed and summarized by the project team. The summary included frequency of deliveries by time of day, expected time period of delivery, the vendors within that time period, the number of vehicles per delivery, type of delivery vehicle, and the type of goods being delivered. Table 1 displays this information as it was provided by Sacred Heart.

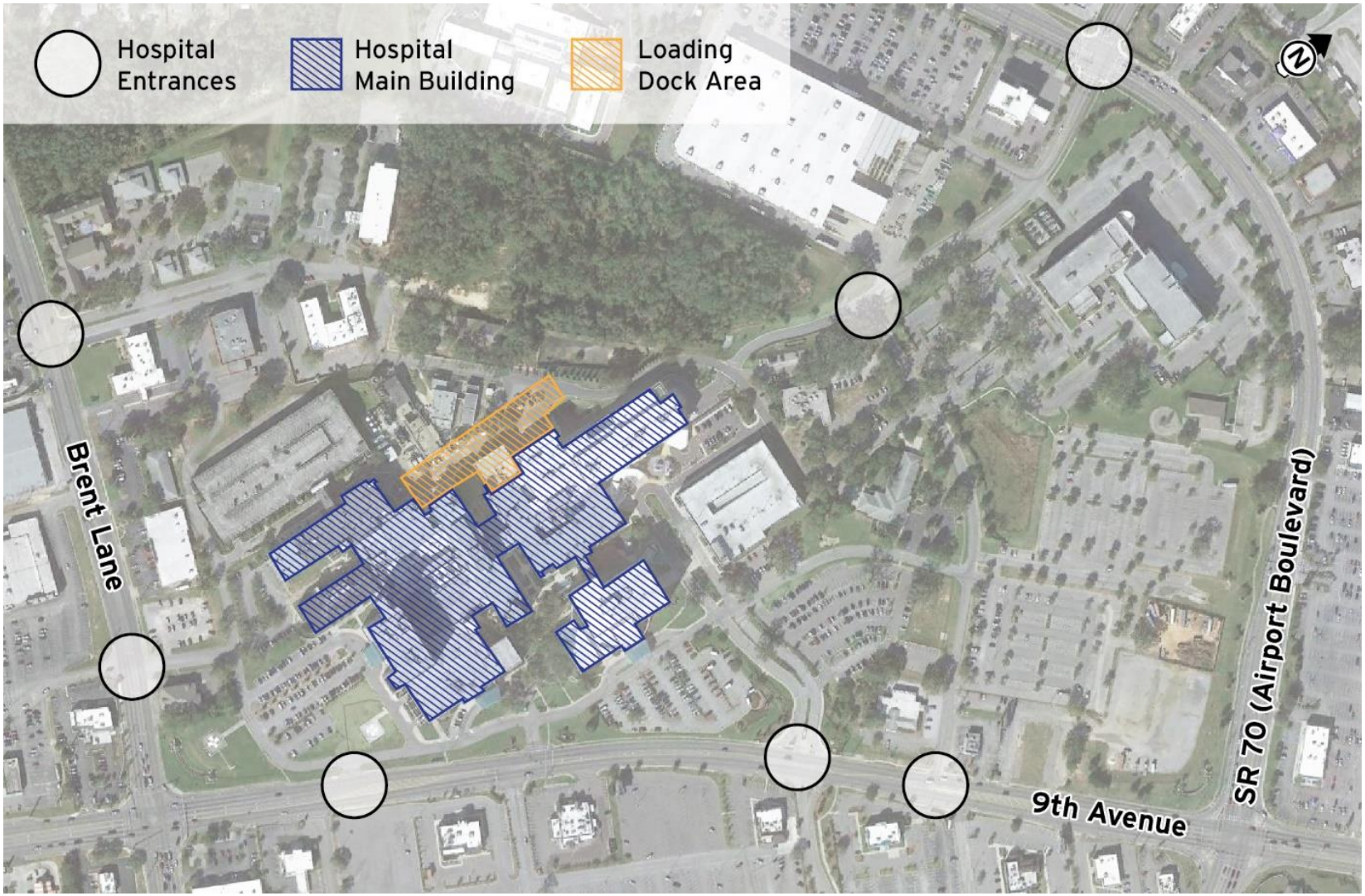


Figure 3: Sacred Heart Pensacola Campus Layout

Table 1: Sacred Heart Deliveries Summary

Department	Frequency	Time	Vehicle	Vendor	Good
Receiving	Daily	5am	Tractor Trailer	Owens & Minor	Medical Supplies
	Twice Daily M-Sa	After 8am	Box Truck	UPS	
	Daily	Afternoon	Box Truck	FedEx	
	Bi-Weekly	Afternoon	Tractor Trailer	FedEx	
	Daily	Noon	Box Trucks	USPS	
	Weekly	Varies	Tractor Trailer	(Siemens, GE, etc.)	Medical Equipment
	Bi-Monthly	Varies	Tractor Trailer	Fuel Vendor	Fuel Tanker
	Annually	Varies	Tractor Trailer		Fuel Tank Cleaner
	Weekly	Varies	Small truck		Medical Examiner
	Daily (M-F)	All Day	Tractor Trailer	Michelson	General Contractor
	Daily	Varies	Small Truck	Otis Elevator	Elevator Repair
Environmental	Daily	Before 7am	Tractor Trailer	Stericycle	Medical Waste
	Daily	Varies	Tractor Trailer	Waste Management	Nonmedical Trash
	Weekly	Varies	Tractor Trailer	Waste Management	Outgoing Waste
	Daily	After Hours	Tractor Trailer	Crown	Linens
	Weekly	As Needed	Small Truck	Root-a-sewer	Sewage Clean
	Bi-Weekly (T; Th)	Late Morning	Box Truck	Dee's Paper	Paper products
Dietary	Monthly	Early AM or Late PM	Small Truck	Multiple	Grease Trap Pump
	Bi-Weekly	Varies	Trailer Tractor	Pepsi	Pepsi Products
	Bi-Weekly (T, Th)	7am	Tractor Trailer	Sysco	Food Products
	Daily	Varies			Produce
	Weekly (W)	2pm	Box Truck	Boar's Head	Meat
	Weekly	Before 7am	Small truck		Water for kitchen
	Tri-Weekly (M, W, F)	2:30am	Box Truck or Tractor Trailer		Dairy
	Weekly (Th)	After 2pm	Trailer Tractor		Paper Products
Pharmacy	Weekly	Varies	Open Cargo Truck	Praxair	Medical Gas
	Weekly	7:30am-8:30am	Box Truck	McKessan	Pharmaceutical
	Daily	Noon	Box Truck	Precision Dynamics	Pharmaceutical
	Bi-Weekly	Varies	Tractor Trailer	Praxair	Large O2 tank
Laboratory	Monthly	As Needed	Box Truck	Stericycle	Hazardous Chemical Waste
	Bi-Monthly	As Needed	Box Truck	Siemens	Laboratory Water

Using the collected data, a needs assessment was completed to identify any potential needs to implement the off-hour delivery program. The findings in the needs assessment identified staffing work hour changes and infrastructure to support the campus policy enforcement, as well as

potential expanded hours of operation of on-site logistics. Infrastructure changes were identified by Sacred Heart due to the expansion on campus, along with the need to provide safe access for vehicles that are not dock height. Additionally, Sacred Heart staff noted that on-site congestion from construction activities, support vehicles, and materials staging might cause additional considerations in the alternative analysis during the study, but that these were temporary issues.

Following the needs assessment, vendors and carriers were to be identified and interviewed for participation in the pilot project. The partnership at Sacred Heart became untenable prior to this phase of the project. However, the selection of vendors would have been based on the type of commodity and their frequency of delivery to the campus. Vendors who agreed to participate would be asked to submit information regarding travel time and fuel logs for trucks delivering to the campus if available. Participating vendors were also asked to maintain the same type of vehicle delivering to the campus throughout the study to maintain consistency in the analysis. Following vendor selection and agreement, a plan was to be developed based on the vendor delivery schedules and the campus' capacity to receive deliveries off-hour. During the six-month implementation, the following performance measures were to be assessed:

- Fuel consumption
    - Estimated Expense
    - Estimated Volume
- Vehicle miles traveled
- Travel time
    - Total Dock to Dock direct time
    - Total Transit overall of the route
    - Schedule deviation
- Idle/Dwell time
- Overall dock time (parked at dock)
- Participation rate of vendors
- Changes in route selection
- Overall Improvement in on time delivery (as a percentage)

Subjective data on the project would also be gathered through anonymous personal experience surveys provided to participants and logistics staff before, during, and after the implementation. The surveys would assist with the analysis of the overall perception and personal experience of those directly involved with the off-hour delivery program and assess the level of comfort, stress, feeling of safety, and ask for general comments.

Communications Management Plan

The communications management plan was established to provide a clear understanding of communication channels and facilitate constant communications with the various partners, vendors and team members involved with each phase of the project. Due to the variations in the size of the project team depending on the phase and coordination required from the partner facility, it was necessary to develop a methodology for communication fallbacks, and a project SharePoint

site to maintain file sharing and common documents. As a best practice for future efforts, it is recommended that the communication management plan be continuously updated and circulated, as needed.

For this project, the communication management plan consisted of the communication type, frequency of each type of communication, format of each communication, distribution lists, deliverables from each communication, and point of contact for each communication.

Cost, Procurement, & Risk Management Plans

The CPM was responsible for reporting the project's costs and providing management for all procurement activities.

The risk management included a process of identifying, scoring, and ranking potential risks to develop the Risk Register. As many risks as possible were to be identified in advance to implement mitigation strategies before they materialized. The four steps listed below were taken for each risk:

1. Risk Identification – determining what the risk is and what could cause it to occur
2. Risk Analysis – determining the probability of the risk occurring and the impact it would have on the project/schedule
3. Mitigation Planning – developing a plan for handling the risk and anticipating the outcome of that plan
4. Risk Monitoring and Control – tracking the risk throughout the project.

Analysis Methodology

In order to assess the efficacy and applicability of the program, a detailed analysis was required to establish baseline measurements against the goals to be achieved by the project. The baseline measurements would be used as an initial benchmark to compare the data collected during and after the implementation of the program in order to evaluate the efficacy and applicability of the program against the goals of the project.

Existing Transportation Conditions

An Existing Conditions assessment of the Sacred Heart campus and surrounding area was conducted to determine preliminary baseline metrics for the off-hour delivery program as a pre-implementation analysis. For the existing conditions assessment, the surrounding roadway facilities were evaluated for traffic operations and safety/crash experience; local community characteristics and land uses were cataloged.

Traffic Operational Analysis

A Traffic Operational Analysis was conducted at the onset of the study to determine the number, distribution, and classifications of the roadways surrounding the campus. This data helped identify critical flow time periods and determine the trends and influence of large vehicles on vehicular traffic flow. Existing traffic volumes around the campus entrances were collected to document

baseline traffic conditions at the eight (8) intersections noted in Figure 2 from December 12 – 19, 2016 for 24 hours each day.

Consistent with the evaluation criteria in the Highway Capacity Manual, the 2012 FDOT Quality/Level of Service Handbook and the latest Florida Transportation Information (FTI) 2015 was used to obtain the arterial LOS along the count locations and supplement the traffic count inventory. The annual average daily and peak hour directional volumes were compared against the five FDOT count sites. Table 2 depicts a comparison of this traffic data with the annual average daily traffic (AADT) volumes.

Table 2: Arterial LOS Summary

Roadway	From	To	FDOT Count Site	Year 2016 AADT	LOS
SR 289 (North 9th Avenue)	SR 296 (Brent Lane)	SR 750 (Airport Boulevard)	485053	34,000	C
SR 750 (Airport Boulevard)	SR 289 (North 9th Avenue)	College Parkway	485300	28000	C
SR 296 (Brent Lane)	SR 289 (North 9th Avenue)	SR 291 (North Davis Highway)	480282	25314	D

As shown in Table 2, at the time of the pre-implementation analysis all the major roadways in the study area operate at an acceptable LOS D or better for an urban area. This analysis does not take into account the presence of heavy vehicles in the roadway system. Higher percentages of heavy vehicles could have an adverse impact on the operational performance of the roadway system.

Roadway Conditions

Field visits were conducted at the campus during peak hours to verify the potential conflict between motorized and non-motorized user groups. The vehicle classification counts and the field observations concluded that the number of heavy vehicles utilizing the entrances at the count locations during peak hours has low impacts on motorized user groups as the number of heavy vehicles observed entering the facility during peak hours was low.

Campus Entrance Analysis

The following section provides a summary of vehicles entering the campus at each entrance during the AM and PM peak hours of the day. The summary of truck data includes a variety of heavy vehicles such as light trucks (includes construction vehicles), single unit trucks, articulated trucks, and buses. For the purposes of this study, it was determined that it was necessary to understand the number of vehicles entering and their frequency as Sacred Heart advised they would gear their logistics operations to a time of day delivery schedule. This would be done to provide time slots during the periods of least activity on campus for trucks and vendors to enter the designated loading and unloading area.

Table 3: AM Peak Period Entering Trucks

Day 1 AM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	0	16	0	1	4	4	4	2	**31**

Day 2 AM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	0	18	2	2	3	1	2	1	**29**

Day 3 AM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	1	6	0	5	3	1	4	2	**22**

Day 4 AM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	2	10	0	0	1	2	3	4	**22**

Day 5 AM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	2	2	0	2	2	2	2	2	**14**

Day 6 AM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	0	4	0	0	1	1	0	1	**7**

Day 7 AM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	0	0	0	1	2	4	1	0	**8**

7 Day AM Peak Period Total Entering Trucks
133

Table 4: PM Peak Period Entering Trucks

Day 1 PM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	0	24	3	5	6	8	8	4	**58**

Day 2 PM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	0	26	4	9	4	7	5	4	**59**

Day 3 PM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	1	12	1	15	4	2	9	7	**51**

Day 4 PM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	3	14	1	4	1	8	9	8	**48**

Day 5 PM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	2	2	2	11	3	3	7	2	**32**

Day 6 PM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	0	6	0	2	4	19	1	1	**33**

Day 7 PM Peak Period									
Entrance Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total**
Entering Trucks	0	0	0	3	3	20	2	0	**28**

7 Day PM Peak Period Total Entering Trucks
309

From this data, the project team developed the following summaries of peak periods for vehicles by type (all vehicles, medium trucks, heavy trucks) entering and exiting the campus during an average weekday, and average week-end day. Table 5 provides a summary of the peak periods by weekday and weekend, and by vehicle type.

Table 5: Peak Periods by Vehicle Type

Weekday Peak Entering Periods		
All Vehicles	**Medium Trucks**	**Heavy Trucks**
6:00 AM - 9:45 AM	7:15 AM - 1:30 PM	6:00 AM - 8:00 AM
11:45 AM - 2:30 PM		8:45 AM - 10:45 AM
		11:45 AM - 2:00 PM

Weekday Peak Exiting Periods		
All Vehicles	**Medium Trucks**	**Heavy Trucks**
10:30 AM - 12:15 PM	8:30 AM - 9:30 AM	10:00 AM - 12:00 PM
1:30 PM - 5:15 PM	10:00 AM - 12:30 PM	12:30 PM - 4:30 PM
	2:15 PM - 4:45 PM	

Weekend Peak Entering Periods		
All Vehicles	**Medium Trucks**	**Heavy Trucks**
4:45 AM: 7:00 AM	4:45 AM - 7:00 AM	5:00 AM - 6:00 AM
3:45 PM: 7:30 PM	12:00 PM - 1:45 PM	6:15 AM - 7:45 PM
	3:30 PM - 4:30 PM	
	6:30 PM - 7:15 PM	

Weekend Peak Exiting Periods		
All Vehicles	**Medium Trucks**	**Heavy Trucks**
5:30 AM - 7:45 AM	10:15 AM - 11:45 AM	10:45 AM - 11:45 AM
5:15 AM - 8:00 PM	4:00 PM - 5:00 PM	5:45 PM - 7:00 PM
	6:00 PM - 7:45 PM	

Safety and Crash Data Assessment

In addition to the traffic assessment, A multimodal safety analysis was completed for the roadways impacted in the study area to determine if the traffic demands combined with geometric conditions pose potential safety issues. To identify crash patterns in the study area, crash data was obtained from the Signal Four Database for the previous three years (January 1, 2013 to December 31, 2015). Crash data was further analyzed to identify potential high crash locations for non-motorized roadway users. To better understand the scenario of multiple entrances, crashes were reported for each surrounding roadway.

A total of 1,186 crashes were reported over the three-year period in the study area. A high concentration of crashes occurred at the intersections of SR 289 / SR 295 and SR 289 / SR 750. This can be attributed to the high traffic volume on the roadway, among other geometric concerns.

Crashes in the study area are summarized in Table 6 and Table 7, based on crash severity, crash type, and crashes during inclement weather conditions. The total number of crashes resulted in 67 injuries and one fatality. Approximately 17% of the crashes occurred at night and approximately 13% of the crashes occurred during inclement weather conditions.

Table 6: Sacred Heart Crash Data Summary

Year	Total Number of Crashes	Number of Injury Crashes	Total Number of Injuries	Number of Fatal Crashes	Total Number of Fatalities	Number of Night Crashes	Number of Wet Crashes	Number of Pedestrian Crashes
2013	360	14	19	0	0	69	44	2
2014	365	18	46	1	1	50	49	2
2015	461	42	2	0	0	85	61	9
Total	**1186**	**74**	**67**	**1**	**1**	**204**	**154**	**13**
Average	***395.3***	***24.7***	***22.3***	***0.3***	***0.3***	***68.0***	***51.3***	***4.3***
Percent	***-***	***6.2%***	***-***	***0.1%***	***-***	***17.2%***	***13.0%***	***1.1%***

Crashes were reviewed and tabulated by crash type in Table 7. Out of the standard crash types, the largest portion of crashes were "rear end" crashes at approximately 29%. "Left turn," "sideswipe," and "angle" crashes were the largest remaining crash types, totaling approximately 21% of the total number of crashes.

Table 7: Sacred Heart Crash Data Summary by Crash Type

Sacred Heart Hospital Pensacola - Nearby Crashes						
Crash Type	**2013**	**2014**	**2015**	**2013-2015 Total**	**Average Per Year**	**Percent**
Rear End	77	119	146	342	114.0	28.8%
Left Turn	47	32	47	126	42.0	10.6%
Sideswipe	29	24	28	81	27.0	6.8%
Off Road	11	7	22	40	13.3	3.4%
Head On	2	5	1	8	2.7	0.7%
Bicycle	2	0	3	5	1.7	0.4%
Angle	15	23	28	66	22.0	5.6%
Pedestrian	2	2	9	13	4.3	1.1%
Right Turn	5	11	11	27	9.0	2.3%
Rollover	1	0	0	1	0.3	0.1%
All Other	169	142	166	477	159.0	40.2%
Total	**360**	**365**	**461**	**1186**	**395.3**	**-**

The loading facilities (docks/bays) within the Sacred Heart campus were also examined to determine their utilization, peak congestion times, and frequency of "turned-away" deliveries. Other information relevant to the study area was also considered, including demographic data provided through the Department's Efficient Transportation Decision-Making (ETDM) software.

Community Characteristics

Understanding the demographics of the study area is important in identifying potential impacts around the Sacred Heart campus. This section provides an overview of transportation-related population and demographics compiled using data collected from the 2014 US Census and American Community Survey Five-Year Estimates and the FDOT ETDM Environmental Screening Tool (EST). In the following sections, population characteristics and demographic features have been summarized in tabular format and illustrated on maps as shown in Figure 4 - Figure 6. An overview of the study area population and demographics are provided in Table 8 using a buffer around the Sacred Heart campus and immediate surrounding area. The data presented reflects an analysis based on abutting Census Tracts/Block Groups.

Below are a few highlights from the analysis:

- The largest number of residents is located in the easternmost block group, which includes the Pensacola International Airport and surrounding neighborhoods.
- The elderly are dispersed throughout the study area, though the largest population is located in the easternmost block group.
- People with a disability are most densely populated in the block group just southwest of Sacred Heart.
- While three of the five block groups identified have median household incomes ranging from $51,000 to $71,000, the block group located north of Sacred Heart has a median household income of $25,244.
    - The last block group's median household income was not reported.

Table 8: Sacred Heart Population Characteristics

Population Characteristic	Study Area
Total Population	772
Population Density (Persons per Acre)	3.96
Total Households	400
Average Household Size	1.94
Household Density (Households per Acre)	1.04
Median Age	50
Population Over 65	17.5%
Male	35.9%
Female	64.1%

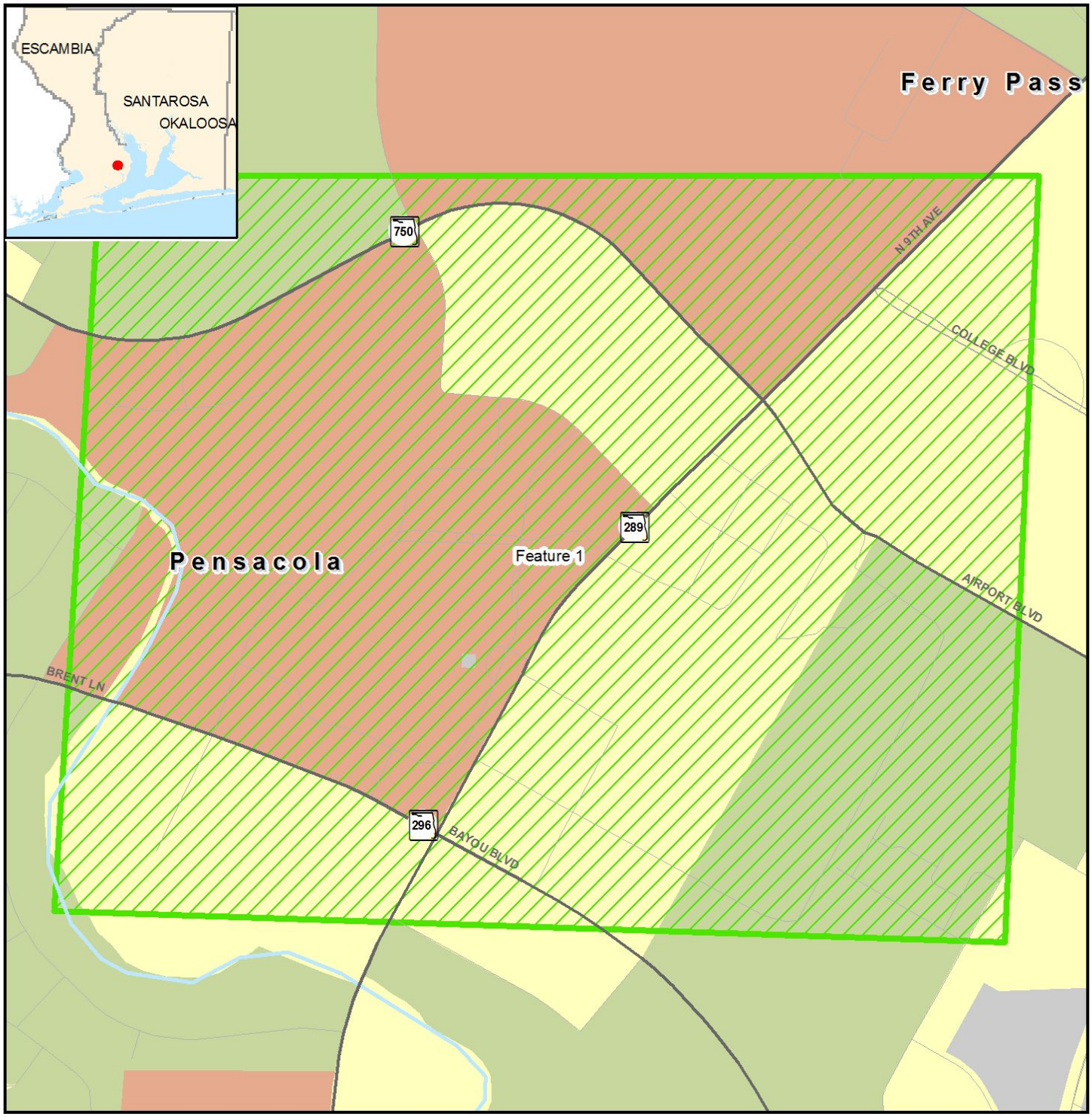
Collectively, this data indicates that the residential pockets and minority populations in the study area are primarily located outside of the block group in which the Sacred Heart campus is located. Therefore, the impacts of shifting peak deliveries to off-peak hours will be low for stakeholders living in the study area.

Socioeconomic data was obtained from the 2014 US Census American Community Survey Five-Year Estimates. Table 9 provides an overview of the socioeconomic characteristics. Figure 4 graphically presents these results.

Table 9: Sacred Heart Socioeconomic Characteristics

Socioeconomic Characteristics	Study Area
Medium Household Income	$45,600
Households Below Poverty Level	16.8%
Total Housing Units	424
Owner-Occupied	192
Renter-Occupied	208
Vacant	24
Households with No Vehicles	53

Figure 4: Age Distribution Map



Age Distribution Map

Area of Interest
Major Road
Local Road or Trail

Median Age
0 - 18
18 - 30
30 - 65
> 65

Data Sources:
US Geological Survey
FL Department of Transportation
NAVTEQ
US Census Bureau (2010)

0 0.03 0.06 0.12 Miles

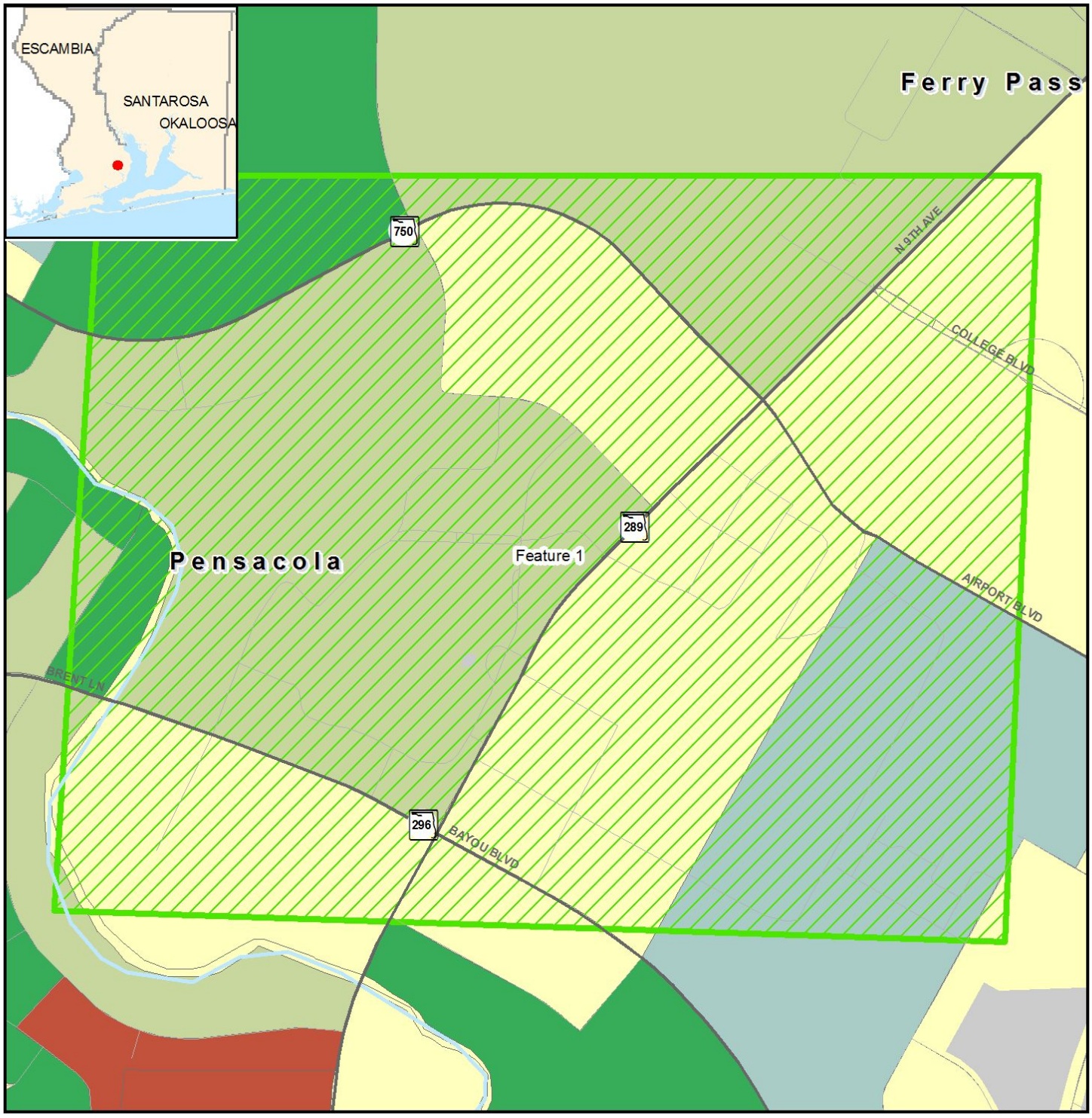
N

1/18/2017

etdm Environmental Screening Tool

FDOT

Figure 5: Minority Distribution Map



Minority Population Map

Area of Interest
Major Road
Local Road or Trail

Percent Minority Population (2010)

0 - 6 | 7 - 20 | 21 - 40 | 41 - 60 | 61 - 85 | 86 - 100

Data Sources:
US Geological Survey
FL Department of Transportation
NAVTEQ
US Census Bureau (2010)

0 0.045 0.09 0.18 Miles

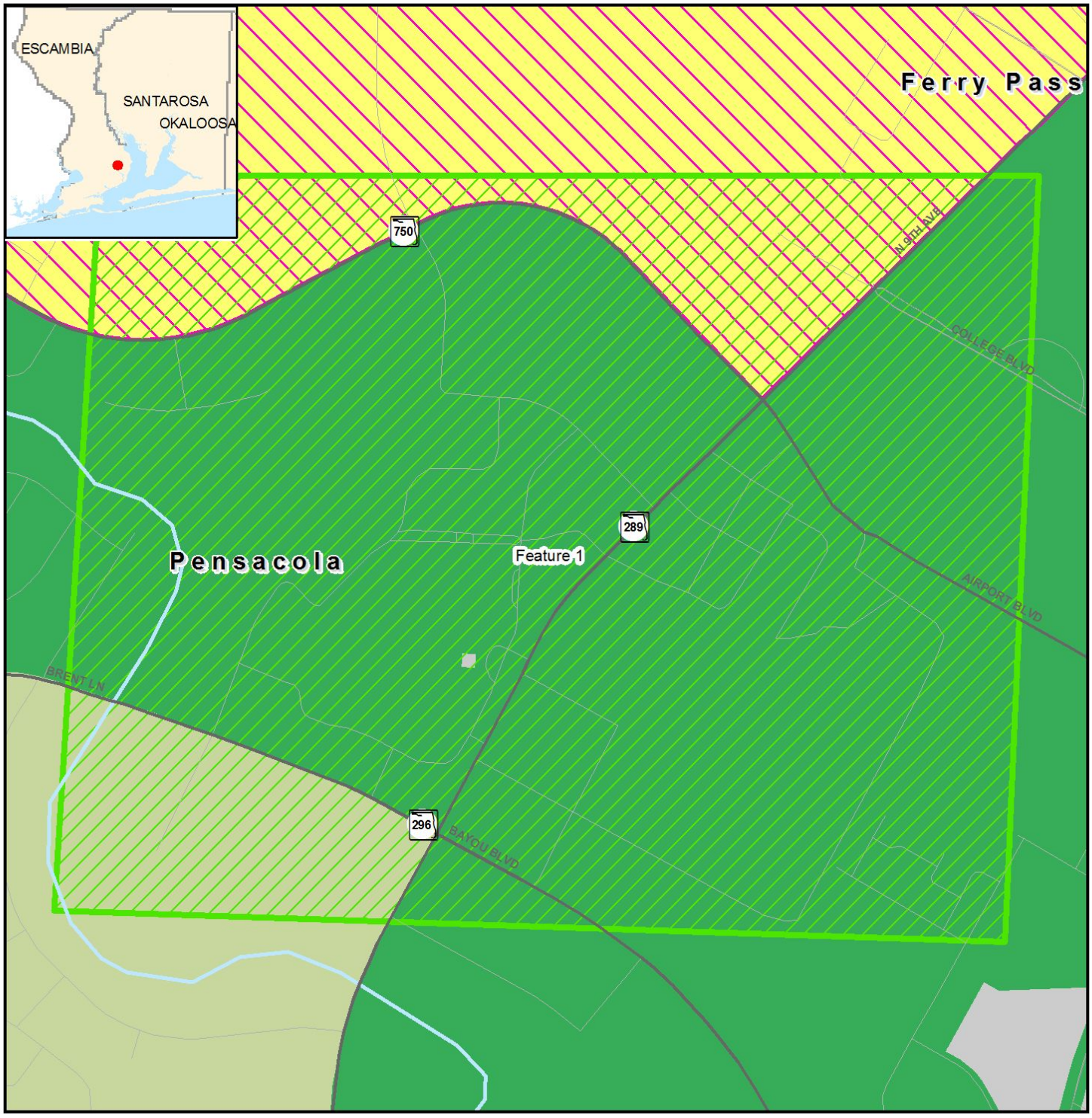
N

1/18/2017

etdm Environmental Screening Tool

FDOT

Figure 6: Income Distribution Map



Income Map

Area of Interest
Major Road
Local Road or Trail
> 20% Below Poverty

Median Household Income

0 - 10,000
10,001 - 29,999
30,000 - 49,999
50,000 - 79,999
80,000 - 125,000
> 125,000

0 0.045 0.09 0.18 Miles

N

1/18/2017

Data Sources:
US Geological Survey
FL Department of Transportation
NAVTEQ
US Census Bureau (2010)

etdm Environmental Screening Tool

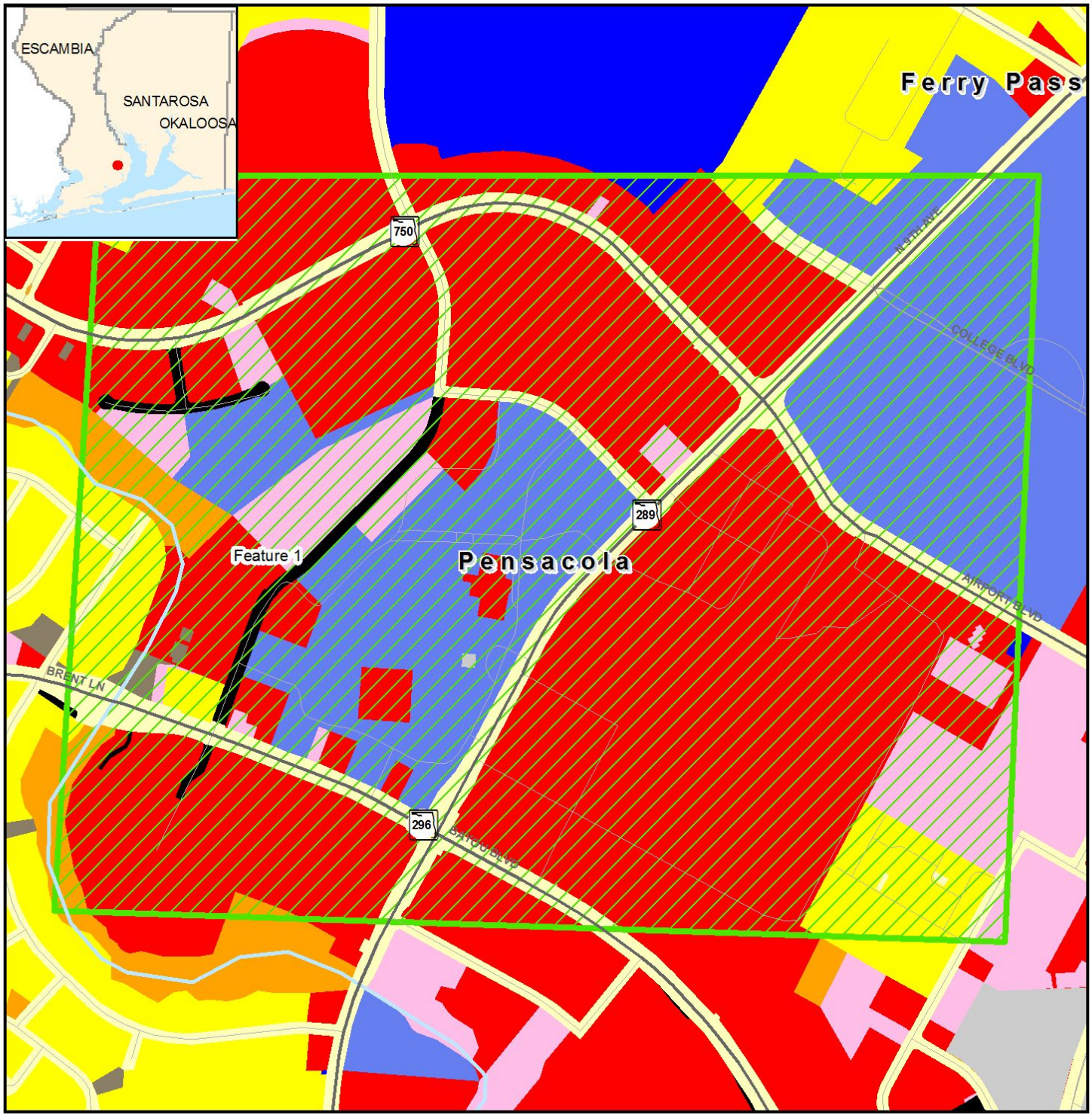
FDOT

Existing Land Use

Existing land use patterns within the study area are important to consider when shifting logistics patterns to a major health facility. For example, the introduction of off-peak delivery leads to an increase of delivery activities at night and can lead to more noise and more disturbances of residents. If a residential community was located along the primary freight route, potential noise issues might occur when shifting to off-peak hours. Adjacent land uses were considered when assessing the effect and impact of off-peak deliveries. This evaluation shed light on both potential users as well as compatible uses that support the off-peak freight delivery model.

The primary existing land use in and surrounding the study area is Retail / Office. Institutional and Vacant Nonresidential are also predominant land uses throughout the study area as shown in Figure 7. The land surrounding the eastern and western boundaries have the highest concentration of residential units throughout the study area. There is a high school north of Sacred Heart, and Pensacola State College is located to the northeast of the campus. One park is located west of Sacred Heart, just outside of the study area. There are numerous health care facilities within the study area, including private practices mixed within the Sacred Heart campus.

Figure 7: Land Use Map



Land Use Map

- Area of Interest
- Major Road
- Local Road or Trail
- Agricultural
- Industrial
- Institutional
- Mining
- Open (Not Agricultural)
- Other
- Public
- Right-of-Way
- Recreational
- Residential
- Retail/Office
- Vacant (Residential)
- Vacant (Nonresidential)
- Water
- No Data

Data Sources:
NAVTEQ
US Geological Survey
Florida Department of Revenue
Florida Department of Transportation
Florida County Property Appraiser Offices

0 0.045 0.09 0.18 Miles

N

1/18/2017

etdm Environmental Screening Tool

FDOT

Site Analysis

The Sacred Heart site was examined at a campus-wide level, with a focus on coordination with delivery vehicles and the facilities team. This study largely dealt with freight movements and their impact to on-site safety, congestion, and deliveries. For the site analysis, the project team observed operations via the data analysis and field visits. During the field visits the project team observed the facilities in operation to understand the complexities of moving freight and cargo in and around the campus.

The site analysis contributed the final inputs toward the development of an alternative. The accumulation of data from the examination of the logistics operations at the dock, the pre-implementation data, and the field observations in the site analysis would enable the team to appropriately develop a time-of-day alternative supportive of the different variables and factors affecting deliveries on site, as well as demands from the distribution network to the Sacred Heart satellite facilities across the Florida Panhandle. The data would be used in both qualitative and quantitative efforts to establish the restrictions to be enforced by Sacred Heart staff.

Communications

Throughout the life of the project, communication was a critical component, and breakdowns in communication channels could cause significant delays. While the project focus was with Sacred Heart, the project team experienced significant delays due to management staff turnover and new structures for logistics operations for Sacred Heart. This often caused a loss of communication for several months at a time, until the management staff was replaced, and the team could restart coordination with the facilities team and the new staff.

Successes

Despite the project never fully moving into the implementation phase, thanks to a substantial due diligence effort at Sacred Heart, the facilities director engaged critical vendors and the corporate-owned distribution network. A definitive answer was not provided by the vendors; however, commitments were made by the corporate-owned distributor MedExcel to honor the facilities team's request to restrict delivery hours. Additionally, the Facilities team led by Sacred Heart staff advised it would support the project with a blanket policy for all of its vendors requiring them to make their deliveries at the loading docks only, and within a specific time range for specific vendors.

Challenges Faced

The most significant challenges at Sacred Heart came from external factors outside of the control of the direct project team. Over the course of the various phases, changing onsite construction schedules, staff changes, and corporate restructuring resulted in the program being untenable within the Sacred Heart Partnership.

As discussed, Sacred Heart indicated that their freight operations were going to be hindered by construction on campus. One of the challenges experienced on this project occurred when realizing the construction schedule. The extent of the freight operations disruption was known as the main entrance was to be block permanently by the new construction. This created the need for infrastructure modifications to the backside of the campus in order for delivery vehicles to safely access the loading area. However, the scheduling of the construction of the new facility, and additional infrastructure floated from expected start dates and caused an indeterminate factor as to whether the alternative can continue without modifications to delivery schedules or locations due to the closure of the entrance, and insufficient infrastructure.

Staff changes with Sacred Heart also posed a significant challenge to the project. The logistics staff that had been engaged with the project team changed throughout the partnership. Each leadership changeover caused a review of the project and the project to be re-presented to the management staff. Additionally, the objectives for the project took on new meaning with each changeover. Ultimately, this caused significant delays in advancing the project, as each new staff assigned to the off-hour project would need to be brought up to speed. Because these were management positions, each new manager brought on board different methodologies for the logistics operations at sacred heart, and the team had to adapt the project schedule to accommodate. Ultimately, the changeover in staff led to unforeseen challenges that caused the project to be untenable at Sacred Heart.

Lessons Learned from End of Project Partnership

This project, while leveraging a significant knowledge base from the previous off-hour delivery projects, encountered new challenges, and identified new strategies and techniques to effectively develop an off-hour delivery program. Additionally, project management decisions made during the project were critical in maintaining a timely schedule with the risks and impacts incurred as discussed previously. These decisions were made to mitigate challenging scenarios or otherwise dynamic situations that would have upset the project schedule or deliverables, such as:

- Continually dynamic construction efforts affecting the alternative or the needs of the alternative
- Dynamic staffing on the Sacred Heart project team that required closer coordination, or project education for new staff
- Availability of data regarding the analysis of the goals
- Dynamic business/logistics operations with Sacred Heart

It was found that it is best to understand the availability of data as it relates to the goals and objective during the agreement process. This will let all parties know responsibilities, but also address feasibility to measuring the goals within the project scope. Understanding future plans in detail for the partner facility will also assist greatly in ensuring that the programs approach can be created allowing for institutional, infrastructure, and personnel changes.

Project Team

Throughout the project, the Project Manager and the Consultant Project Manager maintained constant communication; however, members of the project team that were representatives of the partners involved were often deciding parties as controllers of the facility where the project was taking place. Based on coordination with Sacred Heart, it was determined that the stakeholder representatives are often best identified outside of executive/director staff and that a single point of contact that serves as a facilities manager over logistics is preferred. Additionally, regular progress meetings should be conducted with the partner facility executive staff to support the partner representative's requests with project findings, data, and presentations to garner further support for additional phases.

Florida State University

Carry-Over from Sacred Heart

Following the rework, and restructuring of the partnering agreement, the study location was shifted to FSU. Knowing the complexities and challenges encumbered with Sacred Heart, the Project Team utilized methodologies and lessons learned to evaluate the feasibility of implementation, analysis, and success at the new partner facility prior to commencement. The FDOT Project Team utilized the lessons learned to develop additional vetting criteria for partnership establishment such as data availability, operations stability, discreet freight challenges, and capacity to implement and maintain the program. Since the objectives remained similar for the overall project, the Team was able to utilize a bulk majority of the approach and work plan for the project with only minor tweaks. However, the goals of the program were shifted to align with the challenges faced with freight deliveries at FSU and thus necessitated changes to the analysis methodology.

Initial Goals

Since the challenges faced at FSU focused more on impacts to multimodal facilities, aesthetics and pedestrian safety from freight deliveries, the goals for the project differed upon transferring to FSU. Initial meetings with FSU led to an understanding of unique challenges around the campus:

- Freight vehicles blocking sidewalks and pedestrian access areas during peak pedestrian activity times
- Unscheduled deliveries blocking traffic on main thoroughfares
- Large vehicles travelling through campus creating noise and air pollution concerns.

These challenges were also coupled with larger goals of the campus focused on safety and quality of life for students, visitors, and staff to create specific project goals that the off-hour delivery program would be tested against for efficacy and applicability. These goals can be summarized by the following:

- Improve pedestrian safety by minimizing interactions with freight vehicles
- Improve campus aesthetics by reducing freight deliveries during peak campus activity periods
- Create operational efficiencies for vendors while on campus with reduced conflict and decreased interactions.

The efforts at Sacred Heart had produced a better understanding of data needs and analyses. The work plan was modified to better fit the revised goals for FSU; both regarding the project analysis, and in making the best use of the information available to evaluate the off-hour delivery program.

Project Work Plan

Minor adaptations to the Sacred Heart work plan were made to support the varying objectives for the new study site. These changes pertain specifically to the project scope and data collection and are detailed below.

Project Scope

The scope developed differs slightly for the FSU campus as the nature and location of the deliveries received at this location differ from Sacred Heart, along with the goals for the FSU off-hour program.

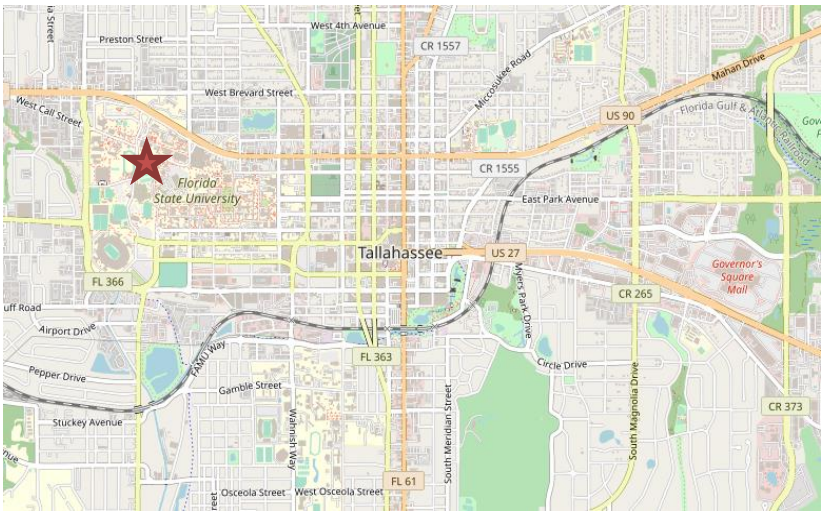


Figure 8: Florida State University Location Map

Deliveries are made to multiple areas of the FSU campus. Therefore, the study focused on the main campus with particular attention to the distribution warehouse and areas with direct shipments (such as the Bookstore on Woodward, Food Services, and vending machine areas). Similar to Sacred Heart, the study site is located in a built-out area with planned expansions that are expected to exacerbate congestion problems.

The FSU facilities team, along with public safety and administration staff, assisted with identification of key issues related to the interference of freight with pedestrians, bicycles, and motor vehicles within and around the campus. The City of Tallahassee also provided insight towards ongoing traffic issues and safety concerns with freight vehicles making deliveries at various times of the day. Based on this input, the project team re-evaluated the project objectives, modifying elements to ensure that the issues identified at FSU would be the focus of the alternative and implementation of an off-hour delivery program.

Just like at Sacred Heart, the scope of work included planning, stakeholder outreach, data collection, monitoring, and transition to an off-hour delivery program that supports freight deliveries and goods movements.

Data Collection

Data for existing logistics operations, safety concerns, points of conflict, site distance issues, and traffic data (including LOS, peak congestion times, percentage of truck traffic, any bottlenecks, etc.) remained the same within the work plan when transferred from Sacred Heart. At the FSU campus, conflicts between the high volumes of pedestrian traffic and truck deliveries were a

primary concern. Pedestrian volume counts and safety information were collected along with the traffic data that was provided from the City of Tallahassee. Information was also collected regarding the class load on campus during peak weekdays, transit schedule and ridership data, public Wi-Fi access point connection data, and parking garage counts and trends. This data was supplied from various departments of FSU.

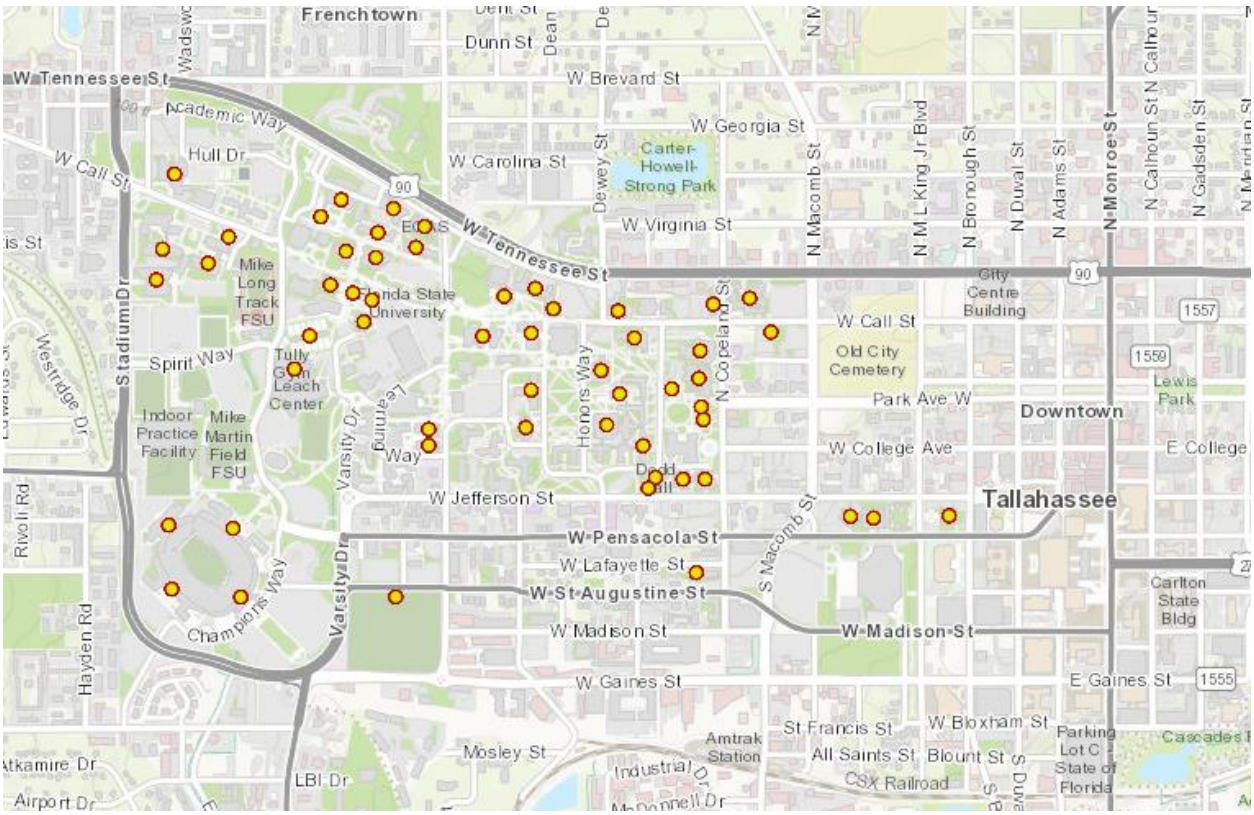


Figure 9: FSU Building Location Data

The needs assessment and plan for vendor and carrier interviews, personal experience surveys, and performance measure tracking remained the same for FSU as for Sacred Heart. However, the project team (collectively with FSU staff) identified at the onset of the project that additional coordination with other departments at FSU was necessary. For this reason, the project team was expanded to include representatives from Public Safety (Campus Police).

Methodology

Existing Conditions

As with the Sacred Heart study area, an existing conditions assessment was conducted for the FSU project area. This included similar components as described in the Sacred Heart study: review of on-site traffic conditions; a review of the safety conditions in the area via site visits; and a review of the current logistics efforts within the campus.

Given the distinction between the Sacred Heart and FSU campuses, there were additional data elements identified for collection for the FSU existing conditions assessment that were not considered in the Sacred Heart study. For traffic conditions the impacts of gameday operations were considered; to understand on-campus pedestrian activity data for classroom/building occupancy and class schedules was observed. There were also existing ITS and transportation infrastructure incorporated into the campus – garage counters, FDOT counts, and campus parking services – that were used to provide additional traffic information. The proposed bus docking stations near the campus' Stadium Drive parking garage were also considered for their potential impact to traffic.

For freight and logistics, the following components were examined: deliveries to food services, bookstores, and vending services; postal service deliveries; trash removal; construction loads; fuel deliveries; HAZMAT deployments; and direct shipping to departments. However, FSU did not readily have a list of vendors with expected delivery times or locations available for use in this study.

Campus Activity Analysis

With focus for the goals dependent on capturing pedestrian movements in conflict with freight movements, it was essential to determine occurrences for peak periods of campus activity on a time of day basis. The methodology to do this centered around the ability to understand peak periods of influx of traffic into campus, as well as understanding peak occupancy around campus. It was determined through project meetings with FSU staff that data for parking garage occupancy around campus were available to the study as well as class schedules with associated class size and location data. The data received from the FSU Registrar's office for class registration contained the registered number of students, time, and location of the class for all classes on the main campus. An assumption was made that the team would evaluate on full attendance as attendance records are not available. Additionally, upon analysis it was clear that there were two weekly patterns with most classes following two schedules: 1) a majority of classes had regularly scheduled lectures on Monday, Wednesday, and Friday; 2) a majority of the remaining classes had regularly scheduled classes occurring on Tuesday and Thursday. There were some classes that only met once a week and were accounted for as individual occurrences within the data, and those occupancies were added to the cumulative sums of their respective day. Figure 10 provides a graphical example of the registration data.

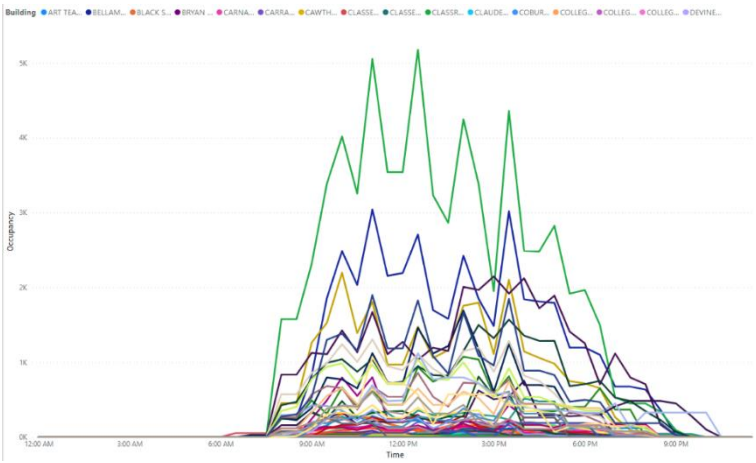


Figure 10: FSU Building Occupancy Derived from Class Registration Data

While the registration data contained significant information towards the determination of campus activity, the team also recognized that some students arrive well before their classes start and may stay longer than the duration of their classes for varying reasons. To account for this, the team requested and received transportation data in the form of parking garage occupancy counts. FSU facilities management advised that the parking garages have counters that record vehicles entering and exiting each garage. FSU staff provided the data across an entire year (Jan 1, 2019 to December 31, 2019) for the project team to analyze. The parking garage data did result in the identification of "hot spots" or activity zones based on time of day for activity around campus as the garages are not concentrated within a particular area. As shown in Figure 11, there was dramatic differences in activity for the parking garages during the summer semester. It was also noted that the Fall semester had slightly higher average occupancy when compared to the spring semester.

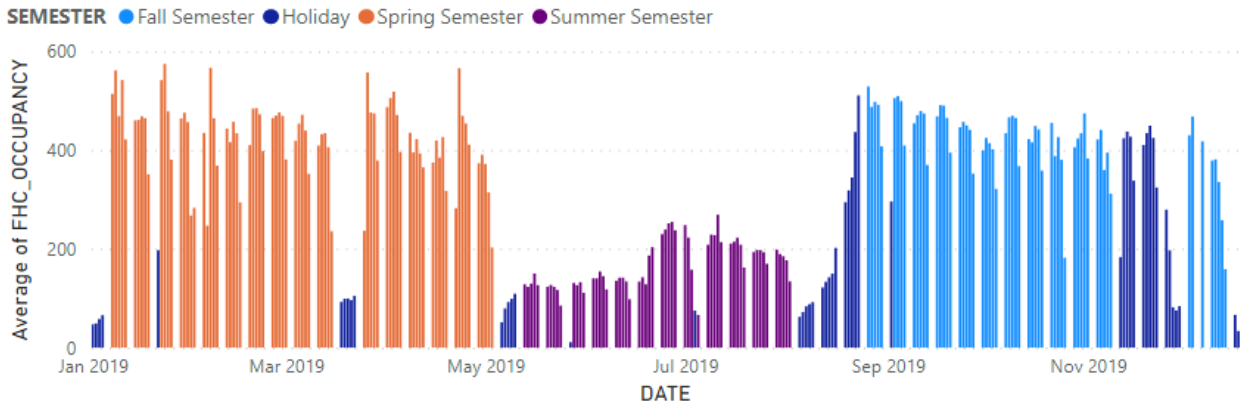


Figure 11: FSU Parking Garage Average Occupancy (All Garages)

In addition to registration and parking garage occupancy data, FSU was also able to provide data from the public Wi-Fi access points around campus. This data consisted of locations of the access points, along with a summary of number of connections by time of day. However, it was determined that the granular scale of data that this represents, coupled with the inability to understand directionality or flow of the internet users, provided ambiguity in its ability to create correlations with the building occupancy data. While the data provided was comprehensive and detailed, it was also cumbersome to incorporate as it was averaged data for exterior and interior access points. If a building contained more than one access point, the data was averaged for that building. Additionally, the access points may have provided erroneous activity zones as Wi-Fi connections may be inconsistent between devices/users and may skip access points along a route if a user is connected to another access point with a strong enough signal. This can cause gaps in collection of active users at access points and may skew the results of the campus activity analysis. Due to the issues with ambiguity of correlation and potential gaps in access point connectivity, it was decided that the Wi-Fi data would not be included as part of the analysis.

Safety Data Analysis

A differing factor from the analysis at Sacred Heart is the focused analysis on impacts within the FSU campus. The project team received safety information from FSU staff and utilized the FDOT State Safety Office Online GIS Portal to access crash data. Figure 12 graphically depicts the aera of analysis and the locations of crashes within it. As part of the analysis, the project team summarized the surrounding and internal facility information as it was determined that many students utilize the surrounding multimodal facilities to access campus facilities rather than a passenger vehicle. Table 10 provides a summary of the severity of all crashes within and surrounding the campus from data that was collected for the time period of January 1, 2016 to December 31, 2019. During this period, a total of 1,642 crashes were reported, with 591 being injury crashes resulting in a total of 797 injuries and 1 fatality over the analysis period. There were also 109 pedestrians involved crashes over the analysis period. Figure 12, above, graphically depicts the analysis area and crash locations.

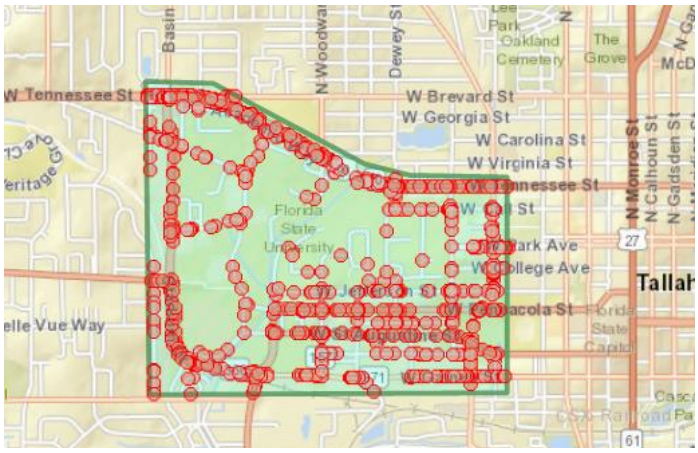


Figure 12: Crash Locations

Table 10: FSU Crash Data Summary

Year	Total Number of Crashes	Number of Injury Crashes	Total Number of Injuries	Number of Fatal Crashes	Total Number of Fatalities	Number of Night Crashes	Number of Wet Crashes	Number of Pedestrian Crashes
2016	396	150	196	0	0	145	29	37
2017	460	172	230	0	0	181	36	30
2018	443	149	198	1	1	133	55	27
2019	344	120	173	0	0	124	27	15
Total	**1643**	**591**	**797**	**1**	**1**	**583**	**147**	**109**
Average	***410.75***	***147.75***	***199.25***	***0.25***	***0.25***	***145.75***	***36.75***	***27.25***
Percent	***-***	***35.97%***	***-***	***0.06%***	***-***	***35.48%***	***8.95%***	***6.63%***

Site Analysis

The FSU off-hour delivery program study was more granular in scope than the Sacred Heart program. This was necessary to account for the student body, which cannot be overlooked in any study of the campus. This led to a greater focus on other modes of transportation – pedestrian, bicycle, and transit – within the context of an off-hour delivery program study. Additionally, the contrasting seasonal impacts associated with summer break and football season also required further examination as it related to impacts on freight deliveries around the campus. As discussed, the methodology for analysis had deviations from the methodology developed at Sacred Heart, which was necessary to account for the re-work of the goals and objectives for the project.

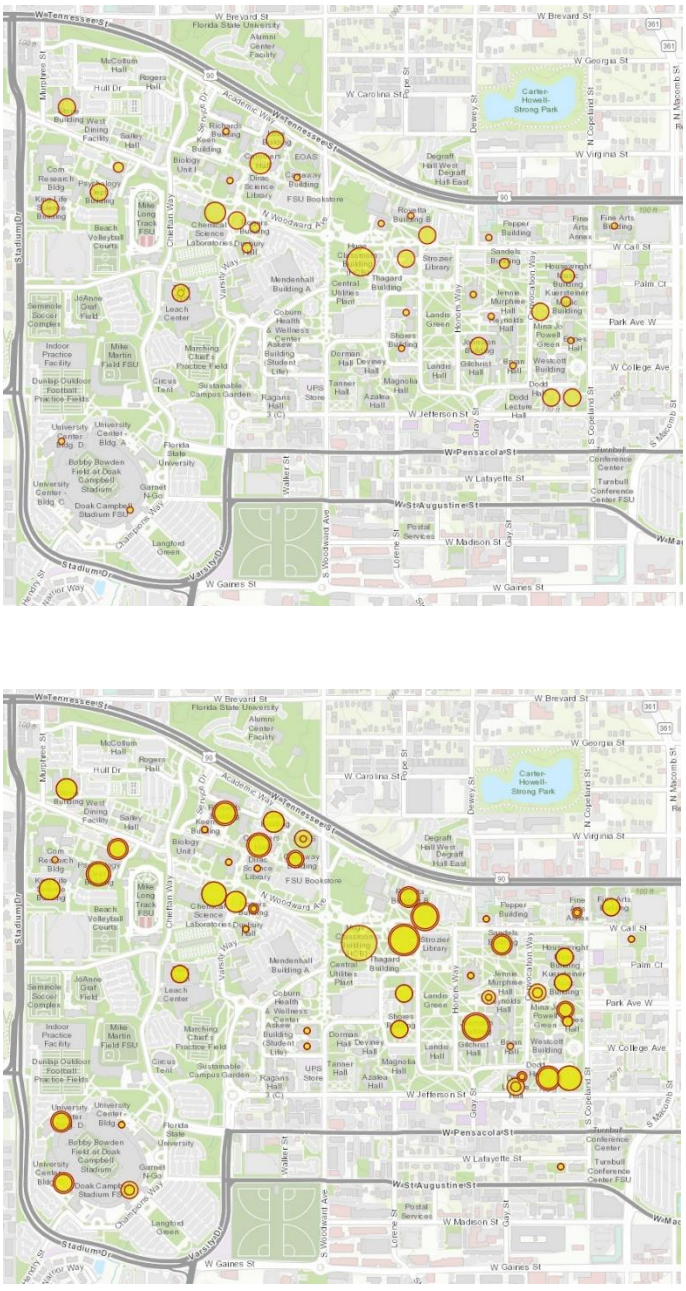


Figure 14: FSU Building Occupancy 12:00 PM (M, W, F)

The site analysis relied heavily on the experience of the FSU staff in handling freight on campus, field observations, and data provided by FSU and The City of Tallahassee. In determination of the best approach, it was decided by the project team that the alternatives should be developed in reference to the maintenance zones established by FSU. The maintenance zones are segmented areas of the campus that have boundaries defined by the FSU building maintenance and facilities teams. These are largely logical breaks around campus that make up three zones. These zones also correlated with delivery areas and activity periods as building occupancy changes throughout the day. Figure 13 and Figure 14 graphically depict an example of the daily occupancy change; in this case between 7:00 AM and 12:00 PM on a typical (M, W, F) class schedule for the fall semester. Because of the need to establish discrete time periods, the site analysis considered comparisons of data used in thirty-

minute periods. It was found that utilizing thirty-minute periods provided normalization between the class schedules, parking data, safety data, and deliveries observed.

Alternatives Development

To better facilitate the site analysis based on the data driven methodology, alternatives were developed around the time-of-day analysis for pedestrian and vehicular traffic around campus. Per the request of the facilities team, an alternative was developed based on the boundaries of the three maintenance zones of the campus. These zones line up with the makeup of facilities across the campus, and the data analysis revealed a correlation between these zones and the movement of pedestrians and traffic across the campus. Due to the focus on the movement of the student body throughout the day, two alternatives were proposed for the FSU campus that were focused on day of the week (Monday/Wednesday/Friday, and Tuesday/Thursday). Figure 15 and Figure 16 graphically depict the alternatives. The times shown in the figures are the recommended times when deliveries should be restricted/denied access. These are the times when the potential for pedestrian movement within that zone is at its highest. The small areas outlined in green show potential areas for exceptions where freight traffic can access loading bays or on street parking without passing by residential buildings or through pedestrian areas.

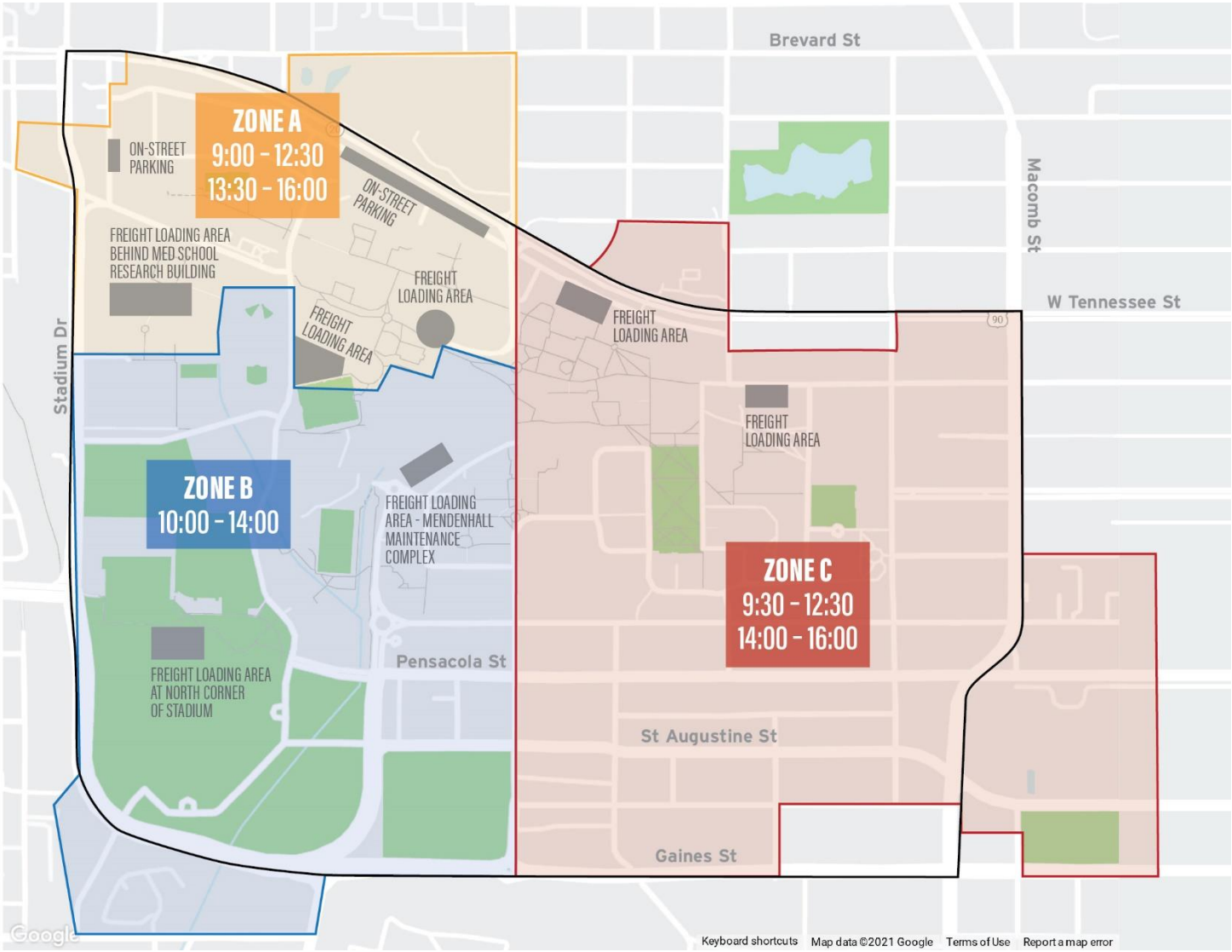


Figure 15: Monday/Wednesday/Friday Alternative

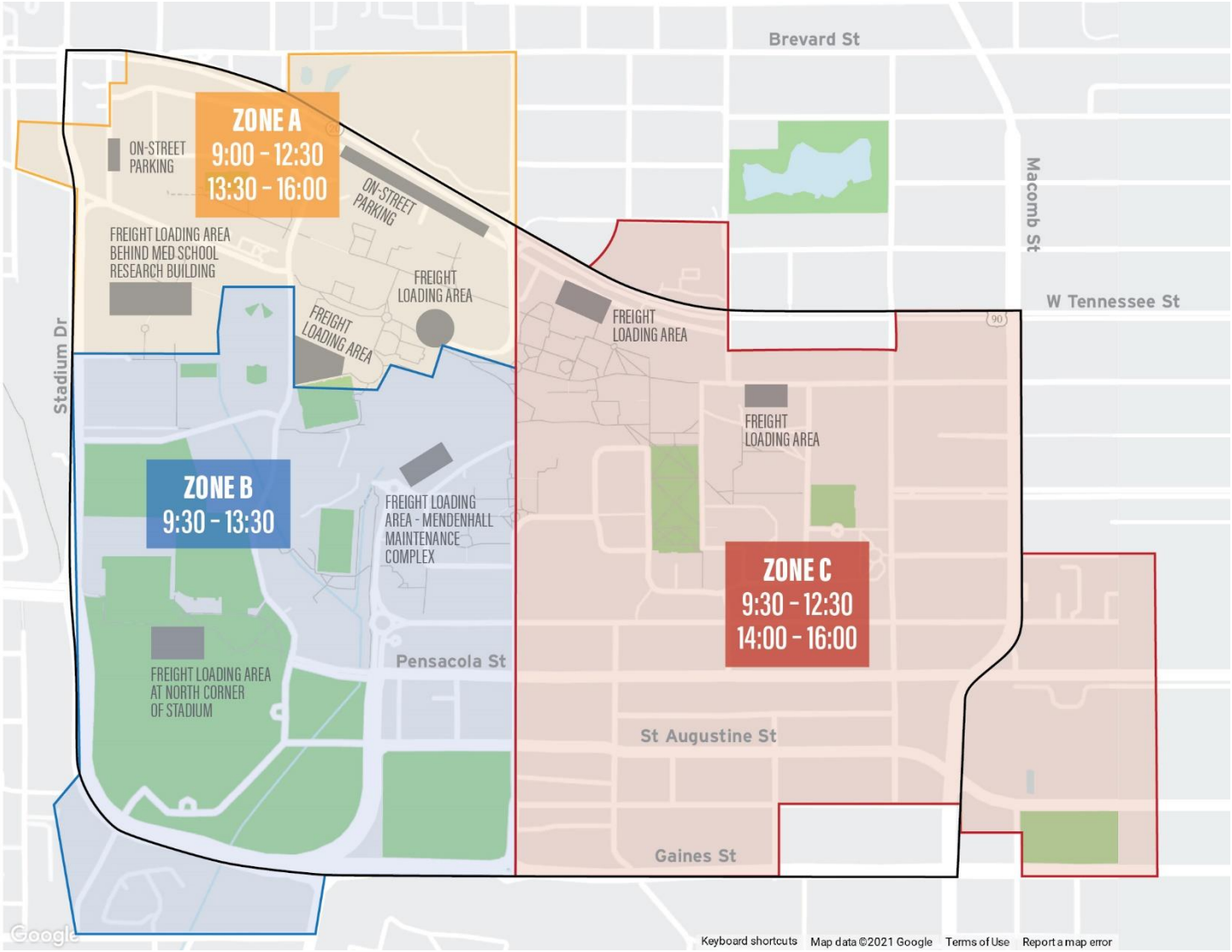


Figure 16: Tuesday/Thursday Alternative

Partnership

The implementation plan for the off-hour delivery program is dependent on partner engagement and commitment. When the project was reworked and a new partnership with FSU was developed, the lessons learned from Sacred Heart were carried over and the partnership was developed with an understanding of data availability, reasonable project expectations, and a willingness to commit resources to the project.

FSU

For FSU, the implementation plan also relied on facility acceptance of the alternative to enforce a policy to restrict deliveries in each zone outside of the proposed delivery hours. This type of implementation would best support a 100% adoption of the off-hour delivery program strategy and provide the best opportunity to measure the impacts and efficacy of the alternative.

The project team was made aware that this was an added task to existing facility members and that the staff involved may not be able to respond in a timely manner to the project team's requests. To account for this, extra time was allotted for coordination and data collection phases in the schedule.

City of Tallahassee

Additionally, the City of Tallahassee coordinated with FSU campus police in an effort to develop an enforcement plan for the policy restrictions on public roadways in the maintenance zones, and identify strategies to leverage digital messaging signs, or temporary signage that would alert drivers of the proposed delivery restrictions based on time of day.

Pandemic Effects

Due to the global COVID-19 pandemic, for the safety of the students, staff, and faculty, FSU made the decision to close the campus and restrict operations. This significantly hindered the ability to implement an off-hour delivery program on campus with activity on campus significantly reduced with most facilities closed. The project team examined the risks of continuing and determined, with FSU staff, to halt the project until a later period when the situation for campus operations could be better evaluated.

Proposed Methodology for Future Off-Hour Projects

Understanding that various external factors prevented future phases from occurring, the project team developed the program such that it can be implemented with a templated and proven methodology. Building from the Central Florida Off-Hour Delivery Program study, this project shifted to create a knowledge base and clear understanding of the potential measurable impacts, such as safety, mobility, and environmental, with the implementation of an off-hour delivery program in different areas. The data methodology is highly repeatable and includes data that is often readily available at facilities and areas where an off-hour delivery program would have the greatest impact. The nature of this project remains highly transferable from area to area within Florida and is driven by increased freight demands on top of increasing growth and congestion within the State's urbanized areas.

Data Sharing

The off-hour program analysis is dependent on access to high quality data to observe the performance and efficacy of the program. The project team established a work plan that would leverage readily available data or opportunities to easily collect the data needed to analyze the efficacy of the program against the objectives for each location. For Sacred Heart, it was identified that an organized log of vendor deliveries and distribution routes was maintained. At FSU, registration records and facility data were available to the project.

A lesson learned during this project is to clearly identify data needs, including the necessary level of detail, at the onset of the technical work plan development. It is necessary that data sharing opportunities be identified in the formation of the partnership. The partner facility may have to share more data than traditionally shared for transportation projects, and it should be made clear the scope and intent of the data required for the project. The analysis of the project should be completed outside of the partner facility to provide a third-party review of data that is independent of the outcome of the project. Additionally, leveraging data analysis techniques with spatial analyses and other data processing tools can significantly decrease analysis effort and identify additional data correlations with both geographical elements and environmental factors.

Furthermore, working with regional and local transportation stakeholders might reveal that additional data is readily available to support the project analyses, and increase the effectiveness of the program by proactively identifying external risk factors. While data sharing is a common practice between public agencies, it is not so common between private and public entities. Defining the requirements of partnership for these programs requires a transparent approach to the benefits and risks at the formation of the partnership to build trust amongst the members of it.

Partnerships

It is important to understand that different levels and types of partnerships may be required based on the region, facility, and type of off-hour program to be implemented. Previous off-hour delivery projects sponsored by USDOT had varying levels of partnerships from data contribution only to compensation-based partnerships. For future efforts, it is important to establish, at a foundational level, the type of partnership most feasible for the operation to be impacted by an off-hour delivery program. Where multiple parties are involved over larger geographic areas, as an incentive, it may be necessary to work with local jurisdictions to develop tax incentive programs to increase adoption and involvement in the program. For single facilities that have extensive impacts, it may be necessary to only engage in partnerships where data sharing and facility operations analysis are agreed upon as contributions to the partnership. For single facilities, the understanding of operations and realized savings from operational costs may far outweigh any available funding for monetary incentives. Additionally, the operations and efficiency increases may make the facility eligible for other credits from state or federal administrations.

It is also imperative that the partnership be established with a clear understanding of the scope of work and the methodology required to achieve a successful analysis and implementation. This helps all parties understand a level of effort, along with identification of additional risks that can be mitigated prior to major efforts. At a bare minimum, the partner should be able to commit resources to provide the project team support with:

- Data collection/discovery
- understanding of logistics operations
- development of marketing materials
- Advertisement of program to vendors/patrons
- Enforcement of the implementation
- Resources to continue the program.

Marketing Materials

While this project never entered an implementation phase, marketing materials were developed preemptively. These materials proved to be extremely useful in presenting the project to local and regional partners as well as to executive staff at the partner facility. Identifying the need for the development of marketing materials ahead of time can simplify the effort to summarize the objectives, purpose, need, and overall requirements for the project into an easily understood document. The partners of the program should assist with the development of these materials as they should be tailored to provide the greatest clarity of impacts of the program, the benefits to be observed, and the opportunities available for participation.

Enforcement

Without the ability to enforce the alternative, a partner facility will have no control over the effectiveness of the off-hour delivery program. It is recommended that partnerships not only be

evaluated based on willingness to commit resources and share data, but also on willingness to enforce the alternative developed for the facility. The ability of a facility to enforce varies between operations, facility type, operation type, and freight type. As observed with Sacred Heart, the private facility recommended that it would enforce the alternative developed for its Pensacola campus by restricting its vendors to only deliver within the time frame allotted (without exception). This provided 100% compliance towards the alternative but the results of the analysis towards the objectives relied heavily on the vendors offering data to the program and volunteering to support the analysis efforts throughout the study period. When the project was reworked and a partnership with FSU was developed, it was observed that the campus consisted of public roadways that were largely uncontrollable in terms of restricting traffic. Enforcement of the alternative in some areas of the campus required coordination with the public safety office and the City of Tallahassee to create ordinances or restrictions for deliveries along with the installation of signage notifying delivery drivers of this restriction. Enforcement of the policy would largely fall onto FSU campus police and the Tallahassee police department.

The understanding of enforcement capabilities should be observed and planned for as enforcement can greatly affect the work plan and methodology of analysis. There is also a risk of schedule slippage while developing resources or actions for enforcement prior to implementation. Understanding the level of effort for enforcement would significantly streamline the feasibility assessment of the partnership and lend to better risk mitigation for future efforts.

Schedule

Throughout this project, the team experienced schedule changes. While many of the changes were from unforeseen circumstances, a key takeaway is to develop a schedule that will allow for flexibility from issues relating to communication with the partner facility and it's vendors. It was found during this project that coordination was significantly more difficult than typical transportation projects. Additional lead time should be allowed for the development of regularly scheduled meetings, large presentations, site visits, and project marketing. The schedule developed for this project focused on a timeline of roughly 24 months. This included an extended period for communication, data gathering and pre-implementation analysis activities as these tasks were dependent on the partner facility and potential participants involvement. The implementation period should be completed over a six month period, including an opportunity to collect baseline data for the same six month period prior to implementation if it is not available from the partner facility or participants. This could mean that schedules could extend beyond a two year period if coordination and pre-implementation analysis activities require additional time to complete.

Conclusion

An Off-Hour Delivery Program can be successful with the support of external partners to implement recommendations. Its benefits can far outweigh its costs as has been proven by off-hour delivery projects around the nation. As this project concludes, FDOT will archive its methodologies and analyses and look to potentially implement the strategy at a later date.

External risk factors forced the project to conclude prior to implementation phases at both locations. However, valuable information and results were gathered from the project's existing conditions data analysis. These results can be leveraged to understand hyper-local freight patterns and scenarios and provide an opportunity to leverage spatial tools to expand the methodologies to analyze larger areas more efficiently.

Overview of Next Steps

For this project, the subsequent phases have been closed. However, the lessons learned and the methodology to expedite site locations and analyses remain transferable. The State continues to maintain high quality infrastructure and traffic operations data that supplement facility operations data to complete the analyses. The next steps for the program are to provide the alternative developed to FSU for use at their discretion once activities at campus return to normal following the closures due to the global COVID-19 pandemic. For the project team, FDOT will evaluate future efforts and may identify a self-led program to implement with support of its local stakeholders.

Potential Future Partnerships

In the evaluation of future efforts, partnerships should be explored that would not only align with state and local initiatives for freight but offer the greatest support for the success of an implementation. Independent of the size of the operation, future partnerships should be evaluated on the availability of data to support the analysis, the enforceability of the alternative, and the presence of discrete challenges to the transportation system by the freight vehicles accessing the facility. The establishment of program objectives aligned with the State Freight and Mobility Trade Program lend to identifying partners, facilities or areas that stand to provide the greatest benefit to the implementation of an off-hour delivery program for all parties involved.